

What are the 3Rs?

The 3Rs – Replacement, Reduction and Refinement – are the scientific and ethical principles that guide the use of animals in research and testing. Scientists should **replace** the use of animals with alternatives wherever possible, **reduce** the number of animals involved to the minimum required, and **refine** procedures and animal care to minimise pain, distress and suffering. Using 3Rs approaches, scientists can maximise animal welfare and improve the quality and reliability of their research. The National Centre for the 3Rs (NC3Rs) was established in 2004 to support the scientific community develop and implement 3Rs approaches, advance the 3Rs in policy and practice around the world, and pioneer better science.

Reduction

Reduction means using the minimum number of animals in an experiment that are needed to produce reliable and meaningful results. Before starting an experiment that uses animals scientists should carefully plan what they are going to do, the type of information they will collect and how they will know whether the results are significant – this is important to avoid wasting animals in studies that do not produce useful data or new scientific findings. Scientists should also collect as much information as they can from each animal to reduce the overall numbers of animals used.

For more information, please visit:

nc3rs.org.uk/3rs-public

lms.mrc.ac.uk/about/animals-in-research

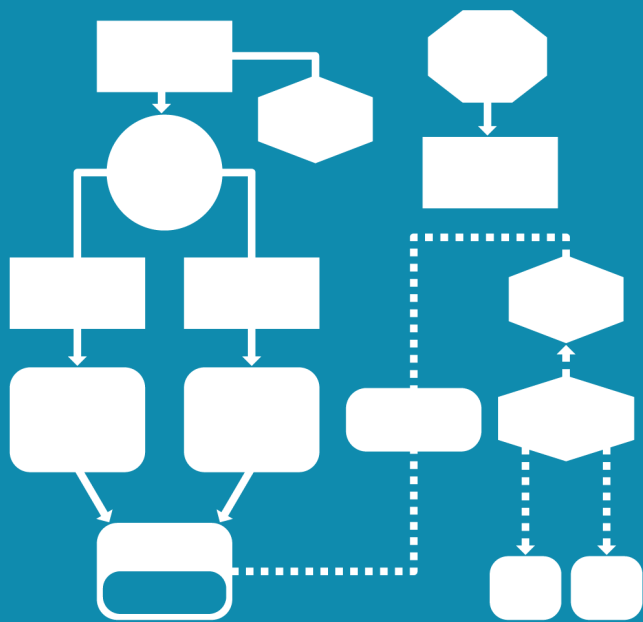
This leaflet was designed and produced with the support of an NC3Rs public engagement award to Dr Yu Liu at the Medical Research Council Laboratory of Medical Sciences (MRC LMS). With thanks to Alice Pollard, Tom Wells, and LMS Geco for their support.



Replacement Reduction Refinement 3Rs

Designing animal experiments

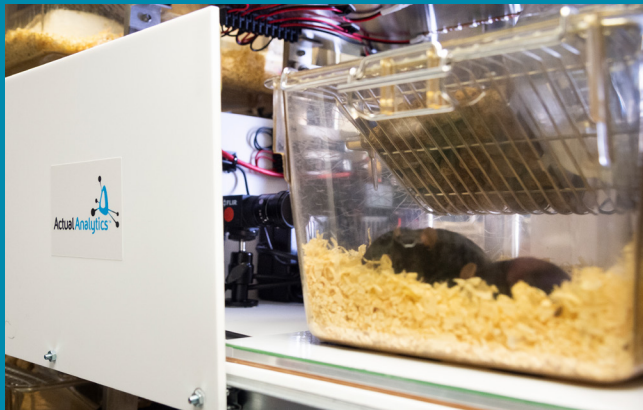
Scientists should plan experiments using animals carefully before they start. This includes knowing the scientific question (or 'hypothesis') they are testing and working out how many animals are needed to find the answer. Choosing the correct number of animals to include is important – if an experiment has too few animals, scientists might miss important information or be unable to tell if the results represent a real scientific finding or simply happened by chance. This could mean that the experiment needs to be repeated, leading to more animals being used overall. The NC3Rs has an online tool which helps scientists to design experiments and use the fewest animals required.



Scientists can use flow charts to plan all the steps in an experiment.

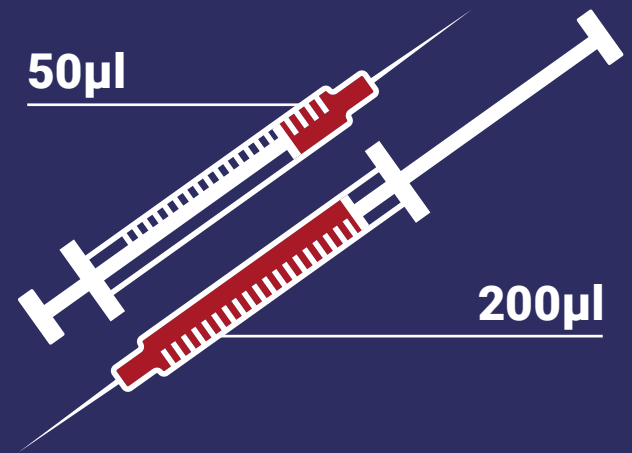
Home-cage monitoring

New technologies allow scientists to continuously and non-invasively gather data from animals. These 'home-cage monitoring' technologies often combine video recording with RFID chips similar to those used for pet dogs and cats. Scientists can gather a wide range of information, 24/7, without interfering with the animals – from their movement and behaviour to eating and drinking habits, alongside vital signs and physiological measurements.



Laboratory rats being monitored with the Home Cage Analyzer system, developed by Actual Analytics with funding from the NC3Rs.

For example, in a study to better understand how metabolism changes in health and disease scientists at the MRC LMS used an automated system to track mouse body temperature every 5 minutes across a day. Combining this with an AI algorithm to analyse the huge data set, they improved the quality of the data from their study and therefore reduced the number of mice that needed to be used.



Microsamples are four times smaller than traditional blood samples.

Microsampling

There are strict limits on the volume of blood samples that can be taken from an animal for welfare reasons, but this can mean researchers use more animals overall to run the tests they need. For example, drug safety studies typically use one group of rats to look for potential side effects and a second group of rats to study how the drug builds up and moves around in the body. Microsampling uses advanced analysis techniques that work on much smaller samples – 50 microlitres instead of 200 microlitres – meaning scientists can collect all the blood samples they need using fewer animals. In a drug safety study, microsampling could reduce the number of rats by over 50% (from 176 to 80). Scientists can also directly compare the level of drug in the body with any negative effects, improving the scientific outcome. Importantly, collecting smaller blood samples also causes less pain for animals.